



The World Bank

Disease Control Priorities in Developing Countries

Edited by

DEAN T. JAMISON

W. HENRY MOSLEY

ANTHONY R. MEASHAM

JOSE LUIS BOBADILLA



OXFORD MEDICAL PUBLICATIONS

14027

CLIC-
CPHE

SOCHARA

Community Health

Library and Information Centre (CLIC)

Centre for Public Health and Equity

No. 27, 1st Floor, 6th Cross, 1st Main,
1st Block, Koramangala, Bengaluru - 34

Tel : 080 - 41280009

email : clic@sochara.org / cphe@sochara.org

www.sochara.org

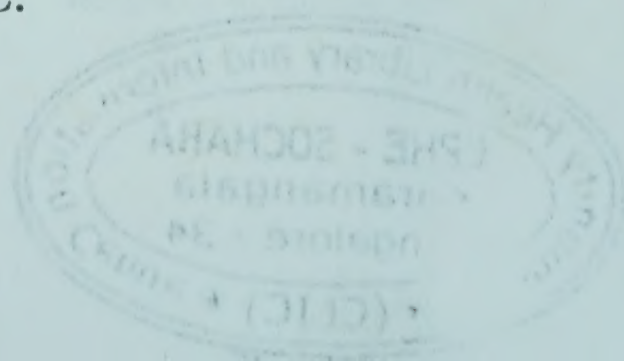
Disease Control Priorities in Developing Countries

A Summary

Editors

Dean T. Jamison
W. Henry Mosley
Anthony R. Measham
José Luis Bobadilla

The World Bank
Washington, D.C.



© 1993 The International Bank for Reconstruction
and Development / THE WORLD BANK
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

This booklet is a summary of a book published by Oxford University Press
for the World Bank.

All rights reserved
Manufactured in the United States of America
First printing September 1993

The findings, interpretations, and conclusions expressed in this study are
entirely those of the authors and should not be attributed in any manner to
the World Bank, to its affiliated organizations, or to members of its Board
of Executive Directors or the countries they represent.

Cover design by Karin Shipman.

Library of Congress Cataloging-in-Publication Data

Disease control priorities in developing countries : a summary /
editors, Dean T. Jamison ... [et al.].

p. cm.

ISBN 0-8213-2480-2

1. Public health—Developing countries. 2. Medicine, Preventive—
Developing countries. 3. Health planning—Developing countries.
I. Jamison, Dean T. II. International Bank for Reconstruction and
Development.

[DNLM: 1. Communicable Disease Control—economics. 2. Developing
Countries—economics. 3. Health Policy—economics. 4. Health
Priorities—economics. WA 110 D6111 1993]

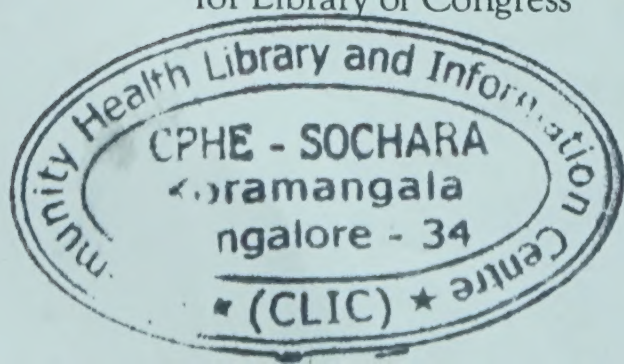
RA441.5.D573 1993

362.1'09172'4—dc20

DNLM/DLC

for Library of Congress

93-29945
CIP



DIS-300
14027 N93

Contents

<i>A Note to the Reader</i>	<i>iv</i>
<i>The Health Transition</i>	<i>2</i>
The Demographic Transition and Population Aging	2
The Epidemiologic Transition	3
Changing Patterns of Risk	5
Epidemiologic Polarization	7
Consequences for the Health System	9
<i>Assessing the Cost-Effectiveness of Intervention</i>	<i>12</i>
<i>Policy Implications for National Governments</i>	<i>15</i>
Policy Instruments of Government	16
An Integrated Approach to Policies and Strategies	17
Analytic Capacity Building	26
Policy Implementation and Health System Responses	28
<i>International Aid</i>	<i>30</i>
<i>Conclusions</i>	<i>32</i>
<i>Contents of the Book</i>	<i>35</i>

A Note to the Reader

This booklet is the second in a series summarizing the main points of full-length World Bank books. *Disease Control Priorities in Developing Countries* is a reference book that addresses the health policy choices facing decision-makers in developing countries as lower fertility and child mortality combine to produce great diversity in the patterns of disease. Noncommunicable disease is a growing threat in the developing world, even in those countries in which the fight against communicable disease and undernutrition is far from over. *Disease Control Priorities* analyzes the research into the prevalence, prevention, treatment, and cost-effectiveness of different interventions, disease by disease.

Disease Control Priorities in Developing Countries

For the past two decades much of the international public health community has focused attention on the communicable childhood diseases (CCDs). The success of CCD control efforts, however, combined with large and sustained fertility reductions in many developing countries, has led to the “health transition.” This term identifies the change from a pretransition environment dominated by high fertility, high mortality, infectious disease, and malnutrition to an environment of low mortality and low fertility with a disease profile that increasingly emphasizes noncommunicable conditions of adults and the elderly.

The changing epidemiologic profiles of developing countries are leading—in many countries quite rapidly—to fundamental changes in the volume and composition of demand for health services and needs for health promotion. The cost-effectiveness of interventions (or value-for-money) was an important consideration even before rapid change in epidemiologic profiles. However, the range of key interventions for communicable childhood disease was relatively limited. This led, through experience, to a reasonable sense of a cost-effective mix of interventions. The situation becomes vastly more complex with the emergence, as quantitatively important, of a broad range of additional conditions. The analysis of health policy can usefully be divided into three tasks. The first task, *choosing interventions*, assesses the cost-effectiveness of potential disease control technologies by combining technical analysis (epidemiologic and clinical) with economic considerations; it also, occasionally, extends to the task of assessing the benefits of intervention in relation to cost broadly defined. The second task, *designing delivery systems*, has dominated thinking about health policy. Economically sensible delivery systems, however, must follow the choice of *what* interventions are to be implemented. The three key design elements for delivery systems—planning the development of human and physical infrastructure, planning the logistical system for drugs and supplies, and planning appropriate information and incentive structures and financial instruments—all depend in important ways on the intervention mix. At the same time, the cost-effectiveness of interventions varies with the capacity of local

infrastructure to deliver them. Ideally, then, the first two tasks of health policy analysis should be addressed iteratively rather than sequentially. The third task of policy, *choosing the appropriate mix of governmental instruments*, deals with what governments can do through provision of information, taxation, regulation, direct investment, and research.

If the familiar pattern of problems in developing countries—communicable childhood disease, undernutrition, and excess fertility—could be expected to continue their dominance of the epidemiologic profile, then there would be little need for a reassessment of objectives. But the response to the massive epidemiologic change already deeply penetrating the developing world has typically been to import the high-cost approaches of the industrial nations to the (very limited) extent that resources permit. The assessment of the cost-effectiveness of intervention options is thus timely. Reassessment of the design of delivery systems and the appropriate role for government are also a priority; but that reassessment must follow identification of the interventions to be delivered (or encouraged) and those to be discouraged.

The Health Transition

Essential to an understanding of the evolution of disease control priorities in developing countries is a reasonable projection of probable changes in the pattern of disease. These changes compose the health transition. They fall naturally into four parts: the demographic transition, the epidemiologic transition, the changing risk environment, and the widening gap in health problems and health needs across social and economic classes.

The Demographic Transition and Population Aging

Health patterns in the developing world during the next three decades will be profoundly influenced by recent and projected future declines in fertility and mortality as these nations pass through the demographic transition. The projected declines in fertility for Sub-Saharan Africa and the Middle East are substantial, averaging 50 percent, whereas the gains projected for life expectancy are more modest, ranging from 10 percent in Latin America to 25 percent in Sub-Saharan Africa. Long-term projections are inevitably tentative; nonetheless, it should be noted that fertility changes of this magnitude in a thirty-year period are not unprecedented. The total fertility rates in the Latin American and Asian regions ranged from 5.5 to 6.0 in the late 1950s and declined to their present levels of 3.3 to 3.5 in less than thirty years. Perhaps more problematic are the projected mortality declines. These do not yet take into account the epidemic of acquired immunodeficiency syndrome (AIDS), which has assumed significant proportions in many countries in Sub-Saharan

Africa and Latin America. Still, much of the developing world is now well through a transition from high mortality and fertility rates to low ones; this demographic transition sets the stage for epidemiologic change.

It is commonly assumed that the changing health picture seen in populations undergoing the demographic transition is primarily a function of the declines in mortality. In fact, however, the age structure and, correspondingly, the cause structure of death during the course of the demographic transition are strongly influenced by the rapid decline in fertility. This occurs because of a phenomenon that is described by demographers as the "momentum" of population growth. To explain simply, with high fertility the age structure of a population is highly skewed toward the young, irrespective of the level of mortality. With sustained high birth rates and larger numbers of women entering the reproductive ages every year, the base of the population is continually expanding as more births are added every year. With the onset of the fertility transition and rapidly declining birth rates, however, the number of births added each year may remain unchanged or even decline. Consequently the age structure of the population will be progressively transformed from the shape of a broad-based triangle to a rectangular or even trapezoidal shape with a narrowing of the base. The pace of fertility decline will be directly reflected in an immediate slowing (and even reversal) in the growth of the youngest age groups. The adult population will, however, continue to grow for several decades because of the continuing aging of the larger cohorts of persons already born. In the very long run (more than a century) the numbers of the elderly in the rapidly growing developing countries can increase in size by more than 100 times.

The Epidemiologic Transition

The transformation in the age structure of mortality associated with the demographic transition leads to a transition in its cause structure that has been termed the "epidemiologic transition." Three phases have been identified in this transition: the age of pestilence and famine, the age of receding epidemics, and the age of degenerative and man-made diseases.

A fourth phase—the age of "delayed degenerative diseases"—has also been proposed. This is to take account of the progressive decline in the death rates from some chronic diseases associated with steady gains in life expectancy among the aged in the United States and some other industrial countries. In the United States it has been reported that these gains in survival among the aged have in large measure been in "disabled" years rather than "healthy" life. If this is the case, improved survival among the aged implies that there will be an increasing, not lessening, demand for health services. In the United States in recent years, however, there have been substantial declines in the incidence of such conditions as heart disease, lung cancer, and automobile accidents.

Lessened infirmity, it appears, can be achieved if medical systems pursue vigorously the path of prevention rather than concentrating on developing sophisticated means of treating diseases after they are recognized.

Once a population comes down to and maintains replacement reproduction levels (total fertility rates approximately 2.1) the population growth occurs only in the population segment beyond the mean age of childbearing (approximately twenty-eight years). The implications of population momentum in older age groups for the health system are dramatic. In Asia and Latin America, where fertility declines have been well under way for the last twenty years, it has been projected from World Bank data that there will be very little change in the size of the populations under age fifteen in the next thirty years; by contrast, the populations over age forty-five will increase by over 130 percent. These increases would represent growth rates of 2.8 to 3.2 percent per year during the thirty-year period, reflecting the momentum of population growth that follows the historical patterns of high fertility.

At the other extreme, Sub-Saharan Africa, which experienced no significant fertility declines prior to 1985, will continue to show large increases in the population down to age fifteen and then smaller increases in the younger ages, reflecting the much later (probable) onset of a fertility decline. In the Middle East and North Africa, a somewhat earlier onset of fertility decline is projected. Again, the large increases in the older age groups in these regions reflect the momentum of population growth.

Even with no change in age-specific morbidity and mortality rates, projected declines in fertility would significantly affect the age structure and, therefore, the relative frequency of different causes of death simply because the population ages. For example, in Latin America, all things being equal, we could expect this change in age structure to be accompanied by more than a doubling of chronic disease among adults in relation to acute diseases among infants and children. In fact, mortality rates from these conditions probably will decline overall. However, these projected mortality declines are greatest (decreases of 60 to 70 percent) in the youngest age groups and least (decreases of 7 to 18 percent) in the oldest age groups.

Interactions between changes in mortality and changes in age structure will result in an even more drastic transformation of the health picture. Again taking Latin America as an example, among children under five only a 2 percent increase is projected in the population size but a 62 percent decline is projected in the age-specific mortality rate, resulting in a 61 percent decline in number of deaths. By contrast, in the oldest age group the projections show a 141 percent increase in the population size but only a 12 percent decline in mortality, resulting in more than a doubling of the number of deaths and an even greater increase in chronic disability.

Changing Patterns of Risk

In addition to changes in population age structure, which is the primary determinant of epidemiologic transition, global social and economic trends are transforming the risk factors for different diseases. The most obvious global shift is from rural to urban living. In 1985, only 31 percent of the population of the developing regions of the world resided in urban areas, in comparison with 72 percent in the industrial regions. But the urban growth rate in the developing regions is projected at 3.6 percent per year through the end of the century, so their urban population will reach 40 percent by the year 2000 and 50 percent by 2015. This rapid shift from a rural subsistence economy to an urban, market-oriented, industrial economy brings with it a range of new health problems. At the same time, economic growth brings with it the wherewithal and knowledge for populations to acquire the nourishment and sanitation that can reduce the incidence of and fatality rates from communicable disease. Reductions in risk for communicable disease combined with increases in other risks have the potential to amplify the effects of demographic trends. However, an important general conclusion from a recent World Bank study of adult health in developing countries contradicts this. It suggests that the *overall* effect of development on age-, sex-, and cause-specific mortality rates for non-communicable disease is to lower them, despite the often-increasing prevalence of well-established risk factors of modern society.

High rates of injuries related to motor vehicles, industrial accidents, and toxic chemicals (for example, pesticides) are one consequence of rapid urbanization, industrialization, and mechanization of agriculture. For example, in Thailand in the age group of one to forty-four years, motor vehicle mortality has been increasing at 30 percent annually, moving from sixth place to first place among all causes of death between 1947 and 1980. In 1978, mortality rates per vehicle were fifty times higher in Ethiopia and Nigeria than in the United States or the United Kingdom. Pesticides in Sri Lanka in 1978 resulted in almost twice as many deaths as occurred as a consequence of polio, diphtheria, tetanus, and pertussis combined. In India, mechanization of grain mills without appropriate protective shields over drivebelts resulted in an increased number of serious injuries. Injuries are particularly a problem in many poor countries, which lack the resources and institutions to establish and enforce safety measures. Noteworthy, throughout the world in developing and industrial countries alike, injuries are now the leading cause of death during half the human lifespan.

Chronic conditions such as cardiovascular disease, cancer, and chronic obstructive pulmonary disease are also recognized to be substantially influenced by economic and environmental factors, some of which are amenable to

modification by the health system. For example, in 1978 the U.S. Department of Health, Education, and Welfare identified lifestyle and the environment as the primary determinants of mortality for all but one of the ten leading causes of death over age one in the United States in 1975. A more recent analysis indicated that just three preventable precursors to premature death in the United States—alcohol, tobacco, and injury risks—accounted for 59 percent of all preventable years of life lost before age sixty-five. They also caused 54 percent of all preventable days of hospital care.

Smoking provides an excellent illustration of an emerging health problem. In the United States it is now well established that tobacco use is currently responsible for more than 30 percent of all cancer deaths, including cancers of the lung, larynx, oral cavity, pharynx, pancreas, kidney, and bladder. The most dramatic evidence of this is the tenfold increase in lung cancer mortality in the United States since the turn of this century. Similar dramatic increases in lung cancer mortality associated with cigarette consumption have been observed in Japan since World War II, and rising rates have also been reported from Singapore and Shanghai in recent years. In some Latin American and Caribbean cities more than half of the young people smoke; it is estimated that at least 100,000 deaths in this region were caused by smoking by the mid-1980s. The rapid increase in smoking in China, for example, has the potential to lead to actual increases in age-specific mortality rates, which would run counter to standard demographic assumptions.

The relation between cigarette smoking and lung cancer illustrates a vitally important feature of chronic noncommunicable diseases—the long latent period between exposure and onset of the disease. Smoking is also one of the strongest risk factors for chronic obstructive pulmonary disease (COPD) and ischemic heart disease; as with cancer, the latency of effect is long for COPD and irreversible; but with ischemic heart disease, cessation confers substantial reduction in risk within a year. These data highlight the importance of taking action to prevent chronic diseases decades before the epidemic appears. Regrettably, the rate of tobacco consumption in developing countries is increasing; consistent with this, a strong relationship has been found between tobacco consumption and higher levels of national income among developing countries.

Ischemic heart disease and stroke are potentially amenable to early preventive interventions. The determinants of ischemic heart disease remain to be defined, and patterns of attributable risk will certainly differ in developing countries from those in the industrial countries, where epidemiologic data are available. Nevertheless several behavioral risk factors are well established. These include smoking, sedentary lifestyle, and high saturated fat diets. In general these behaviors are strongly associated with urbanization in low-income countries.

An increase in the rate of ischemic heart disease is already being seen in some developing countries as they proceed through the epidemiologic transition. Singapore has experienced a doubling of the heart disease mortality rates during the past two decades in older age groups, although there appears to be a leveling off in the increase among younger males in recent years. As shown by the experience of Japan, however, which has a low rate of ischemic heart disease (although not stroke), economic development need not be associated with the disease patterns seen in most Western populations. Developing countries generally have fewer risk factors for some of the diseases associated with Western culture. The course of these chronic diseases in the future will depend on the choices made by developing countries as they consider alternative health development strategies while proceeding through the epidemiologic transition.

The onset of the global AIDS epidemic has brought sexually transmitted diseases (STDs) to the forefront of the health agenda of many developing countries. The risk factors for STDs are directly related to patterns of sexual behavior. These, in turn, are often related to the development process. For example, in many developing countries, factors contributing to high rates of STDs include increasing urbanization with disruption of traditional social structures, increased mobility for political or economic reasons, poor medical facilities, and high unemployment rates. Data show that the high rate of human immunodeficiency virus (HIV) infection in eighteen African cities can be correlated with a low ratio of females to males in urban centers, creating a high demand for prostitutes. An associated factor of significance is the relatively low level of female education, which suggests that where there are fewer alternative economic opportunities for women, prostitution is more frequent. Reducing the risk of HIV in these circumstances will probably require significant social changes relating to the role and status of women (including increasing female education) as well as promoting the use of condoms and treating coexisting STDs.

Epidemiologic Polarization

In recent years economic growth in the developing world has not been steady. The worldwide recession, poor economic management, and the excessive accumulation of debt have led to serious setbacks in the economic circumstances of many developing world countries. One potential consequence has been the stagnation or even decay of the health advances that had been achieved in recent decades in some countries, which is often reflected in a rising occurrence of childhood malnutrition. These setbacks, combined with a wide disparity in health conditions of different social classes, have been characterized as “epidemiologic polarization.”

Available evidence suggests that these setbacks in progress and continuation of polarization rarely result in a reversal in the pace of mortality decline, even for Africa. A recent report of the demographic and health surveys in twenty-seven countries in Africa, Asia, and Latin America, carried out between 1986 and 1990, showed declines in mortality of children under age five in every country; by region the average percentage declines were: North Africa, 46 percent; Latin America, 32 percent; Asia, 28 percent; and Sub-Saharan Africa, 12 percent. Although effective health interventions may have blunted the potential mortality consequences of economic stagnation, evidence is emerging from several countries that low child mortality levels can now be maintained even in the presence of sustained high levels of malnutrition and morbidity. It is important that the persistence of these undesirable states not be masked by undue focus on (relatively) favorable mortality statistics.

The 1980s saw a wide disparity in levels of child mortality (under five years) among developing countries in every region of the world. Mortality levels ranged from under 2.5 percent in Costa Rica and Cuba to over 20 percent in Bangladesh and Mali. Within countries as well, significant disparities in health conditions were found among subgroups of the population. Levels and differences in mortality of children under age five, grouped according to urban as against rural residence and the mother's level of education, have been tabulated. These data indicate child mortality rates 30 to 50 percent lower in urban than in rural areas and a two- to threefold difference in mortality between children of women with no education and those of women with seven or more years of education.

The relation between maternal education and child survival in developing countries has been observed in multiple studies during the past decade. This relationship has led some demographers to observe that what counts in child survival is not just the overall health and socioeconomic condition of the country but the individual's (or family's) social and economic resources. The urban-rural mortality differences provide one indicator of the disparities between families in different settings. Thus, since social and economic development usually does not occur uniformly throughout all areas of a country, one will frequently see important differences in mortality rates in different geographic regions within countries. Examples include Mexico, Brazil, Kenya, Nigeria, India, and Indonesia. Thus, epidemiologic polarization occurs not only across social classes but in regional mortality differences as well.

There are relatively few data on mortality differences by social class among adults in developing countries. Where data are available, the patterns are similar to those well documented in the industrial countries; mortality rates for most chronic diseases among adults are higher among the lower social classes than among the upper classes. For example, a study in the rich and poor areas of Pôrto Alegre, Brazil, found that death rates for men between forty-five and

sixty-four were 50 percent higher among the poor; death rates for cancers, cardiovascular diseases, respiratory diseases, and injuries were all higher among men living in poor neighborhoods. The reasons, as in the industrial countries, relate to a high-risk lifestyle that includes alcohol consumption, smoking, lack of exercise, and obesity, as well as poor living and working conditions.

In many countries of the world, particularly across Asia, women experience excess mortality as compared with men because of their marginalized position in society. These excesses are most evident in the higher rates of infant and childhood mortality among females. Another reflection of the disadvantaged position of women is the extraordinarily high rate of preventable maternal mortality in many developing countries, which is 100 to 500 times higher than in the industrial countries. Among the surviving women, studies in many parts of the world have documented a higher prevalence of stunting and micronutrient deficiency. The enormity of this problem has recently been shown in an analysis of the estimated deficits in the female population of several Asian countries; the deficits were derived from a comparison of the actual ratio of males to females with the expected ratio if there were no excess female mortality. For China and India, from 5.3 to 5.6 percent of females were “missing,” indicative of a deficit of 52 million in these countries.

Although noncommunicable diseases and injury will become more prominent with the epidemiologic transition, the infectious diseases, malnutrition, and excess (unwanted) fertility cannot be ignored. These will, however, become even more concentrated among the poor, leading to the phenomenon of epidemiologic polarization. Tuberculosis is illustrative of a leading disease that remains on the unfinished agenda of developing country health problems. In most developing countries, the annual risk of infection ranges now from 0.5 to 2.5 percent, a level 50 to 200 times greater than in the industrial countries. Significantly, this disease alone accounts for about 26 percent of an estimated 7 million *avoidable* adult deaths in the developing world. It is projected that as many as 2.9 million tuberculosis deaths will still occur annually by 2015. Because of the contribution of the HIV epidemic to tuberculosis, coupled with the rate of population growth in Sub-Saharan Africa, the number of deaths projected could increase by more than 100 percent in that region during the next twenty-five years.

Consequences for the Health System

A central consequence of the health transition for health policy is that in most developing countries, pre- and postepidemiologic transition problems will coexist. Table 1 is an attempt to summarize health problems on the current agenda that need continued attention and neglected or emerging problems that are likely to require substantial increases in effort. These categories are defined

Table 1. Health Problems Affecting Various Age Groups in Developing Countries

Age group	Population (millions)		Deaths (millions)		Important health problems	
	1985	2015	1985	2015	Unfinished agenda	Emerging problems
Young children (0–4 years)	490	626	14.6	7.5	Acute respiratory infection Diarrheal disease Learning disability Malaria Measles, tetanus, polio Micronutrient deficiencies Protein-energy malnutrition	Injury Learning disability
School-age children (5–14 years)	885	1,196	1.6	1.3	Geohelminth infection Micronutrient deficiencies Schistosomiasis	Learning disability
Young adults (15–44 years)	1,667	2,918	5.0	6.0	Excess fertility Malaria Maternal mortality Tuberculosis None	AIDS Injury Mental illness Sexually transmitted diseases Cancers Cardiovascular disease Chronic obstructive pulmonary disease Diabetes Cataracts Depression Disability
Middle-aged (45–64 years)	474	1,131	5.9	10.4		
Elderly (65+ years)	153	358	11.0	22.5	None	
Total	3,669	6,229	37.9	47.7		

Note: Many conditions for older age groups manifest themselves clinically long after the processes leading to the clinical condition have been initiated; preventive intervention will, therefore, need to be directed to younger populations.

Source: Figures for population and deaths calculated from R. A. Bulatao and P. W. Stephens, “Estimates and Projections of Mortality by Cause: A Global Overview, 1970–2015,” World Bank, Washington, D.C., 1990.

in light of the indicated change in the age distribution of mortality. Health systems of developing countries will be facing unprecedented increases in the volume and diversity of problems they must address; the challenge is to respond with maximal effectiveness, given the sharp constraints on their resources. Assessing intervention cost-effectiveness is an essential first step to meeting that challenge.

The composite effect of the demographic transition and the socioeconomic changes on the health system that are foreseeable for the next thirty-five years—mainly urbanization and higher levels of education—will be formidable. Four main effects are highlighted as they apply to most of the developing countries.

First, the total burden of disease, measured by the number of days that people suffer from acute episodes of disease, chronic disabilities, and days lost as a result of premature death, will increase. This is not only because the population will continue to grow but also because the prevalence of disease will increase as more chronic diseases predominate in the health profile. The adult population suffers more diseases simultaneously and these tend to last longer, as compared with child morbidity. In addition the emergence of new health risks as described earlier will lead to higher rates of incidence of some conditions, particularly lung and breast cancer, some accidents and violence, and AIDS.

Second, the demand for health services will be greater. Demand is a direct function of three factors that tend to move in the same direction: health needs that were described before; the threshold for converting need into demand, which will decrease as a result of the higher levels of income and education of populations and the accessibility to information acquired in urban areas through radio and other mass media; finally, the supply of services, particularly those provided by hospitals—that is, the increased proportion of populations living in urban areas will improve the physical access to health facilities and therefore will boost the demand for services.

Third, the emergence of noncommunicable diseases and disabilities due to injury will increase considerably the complexity of the health care services required. In general, health personnel will require higher qualifications and probably some level of specialization. The technology for diagnosis, treatment, and rehabilitation will be more sophisticated, and the organizational arrangements to ensure minimum standards of care will also increase in complexity.

Fourth, all the previously described effects will increase expenditure for health care. The one that has the greatest relevance is probably the higher cost of medical care that will result from the greater complexity of services, particularly the introduction of new health technologies. The greatest effect of the health transition is likely to be seen in hospitals. Most developing countries provide hospital services for only a fraction of the population. The demand for services is already greater than the supply. The shortage of hospital beds will,

according to the effects described above, be exacerbated. Three primary causes for hospital admission are likely to grow: childbirth, noncommunicable diseases, and injuries.

Assessing the Cost-Effectiveness of Intervention

The objectives of intervention as categorized here include primary prevention, secondary prevention, cure, rehabilitation, and palliation. Although there is some tendency for interventions that are oriented toward public health to have primary prevention as their main objective, this is far from universally true; by the same token, some clinically oriented interventions also seek primary prevention.

The cost-effectiveness of any given intervention varies according to circumstances. A particularly important source of variation, however, results from the general mortality level of the environment. Intervention attractiveness can vary quite substantially, depending on a country's progress through the health transition.

A critical choice in applications of economic analysis to resource allocation is that of whether to value outcomes because of their economic benefits or because of some more proximal effectiveness measure. Ideally, economic benefits would be the criterion. When there are good markets for products, benefits can be assessed in monetary terms by using market prices (that is, willingness of consumers to pay) to value benefits. Even when willingness-to-pay valuation cannot be assessed directly because of lack of market prices, as is typically true in the health sector, questions in surveys are increasingly being used to elicit information about hypothetical willingness-to-pay. The applicability of this method to the health sector remains to be assessed. Nonetheless, pervasive problems of consumer ignorance of effectiveness of intervention and a widespread tendency for individuals systematically to underestimate risks suggest that willingness-to-pay assessments will probably have limited application to health. An alternative approach—sometimes called the human capital approach—is to view health investments as instrumental to improving economic productivity; estimates of the effect of a health intervention on productivity thus provide a lower bound to total benefits. It is worth noting that willingness-to-pay and human capital approaches tend to imply different values to be attached to the life of different individuals of the same age in the same country. It has been found, however, that willingness to set a cutoff level of acceptable cost-effectiveness results in equivalence between cost-effectiveness and cost-benefit approaches.

More typically, outcomes will be assessed in deaths or disability averted, and the task is to come up with some measure for making such an assessment that allows comparisons across the health sector, even if intersectoral comparisons

(cost-benefit analyses) remain infeasible. If one is simply assessing the relative attractiveness of alternative means for achieving a single, specific health objective—for example, reducing infant mortality—this measurement problem disappears, and one can judge intervention cost-effectiveness simply in terms of, say, cost per infant death. Nonetheless, inherent difficulties remain. The use of ratings based on expert judgment is probably the best that can now be done if the purpose of the analysis is to compare interventions across the sector, although these measures must be used with care.

A workable measure for effectiveness for most of the analysis is disability-adjusted life-years gained (or DALYs). The DALY gain associated with averting a death is, simply, the number of years between the age at which the death would have occurred and the individual's expected age at death, given survival to the given age, with years gained in future years discounted back to the present. Unhealthy life-years are given lower weights than healthy ones (by the rating procedure described above), so that the effectiveness of interventions to address morbidity or disability can be measured in terms that permit comparison with interventions that avert mortality. Costs are generally assessed at market prices. In some cases, however, for some inputs into health care, costs may be lower in developing countries (for example, for semiskilled labor). These costs are typically for inputs that cannot be traded internationally, and their existence undermines attempts to estimate costs that are not simply country-specific.

It would appear that for drugs, for most equipment, and for high-level manpower, considerations of cost variability between high- and low-income countries are essentially irrelevant. For facilities and lower-level manpower they *are* likely to change some numbers. In most cases, however, costs can more reasonably be expressed in constant dollars than, say, as fractions of local per capita income—a method that assumes essentially no health sector inputs to be internationally tradable. Local costs will often be important. Those who attempt to assess country-specific cost-effectiveness should pay close attention to this issue unless the market for foreign exchange is completely free, and the costs of nontradables are similar to those of the comparator country.

Another issue concerns treatment of costs that will ensue from intervention success; substantial food costs can result from micronutrient supplementation or parasite control, for example. The existence of such costs suggests the importance, in these cases, of broadening the definition of the intervention.

A final issue concerning cost analysis is that of joint costs, that is, the situation in which several interventions are essentially made available with a (partially) common set of inputs. This issue can be clarified by combining interventions into natural packages; for example, the preventive intervention for polio can be considered to be diphtheria-pertussis-tetanus vaccine plus polio immunization, and the cost-effectiveness of that package can be assessed,

because polio immunization would (almost always) be given with the vaccine. In many cases, however, such packaging would get too bulky.

Many important factors lead to variation in cost-effectiveness, and, to the extent that interventions are first applied where their cost-effectiveness is highest, these factors collectively will lead to rising costs per DALY with increased application of an intervention. The cause of the phenomenon of rising costs per DALY is, frequently, the lack of intervention specificity and, also frequently, costly targeting and compliance problems. *Intervention specificity* refers to the fraction of intervention from which recipients would benefit, assuming that the intervention is applied exactly to the individuals to whom it should be applied. For example, BCG (bacille Calmette-Guérin) vaccination should be applied to all newborns, but it is a benefit only to that tiny fraction of children who would have died in childhood from miliary tuberculosis (TB) without it. Tuberculosis chemotherapy for sputum positives, however, although costly, will virtually never be applied when unneeded; it is highly specific. Targeting BCG or other interventions to populations at highest risk, at least until full coverage can be afforded, will maximize cost-effectiveness while simultaneously advancing equity objectives.

In addition, targeting costs and compliance costs can dilute cost-effectiveness. Treatment can be very cost-effective for self-referred compliant patients; as compliance becomes more problematic, or targeting more costly, cost-effectiveness decreases. For example, oral rehydration therapy (ORT) in the hospital or clinic setting is highly cost-effective. When ORT is taken to the community, however, cost-effectiveness declines substantially, both because of a decrease in intervention specificity (mild cases will be treated unnecessarily) and because home treatment will be applied less effectively than hospital treatment in severe cases. Similarly, targeting costs can be decreased if an immunization program to prevent neonatal tetanus shifts from trying to reach pregnant women to immunizing all childbearing women, although there will be a loss of specificity (at least with respect to preventing neonatal tetanus but not, presumably, with respect to adult tetanus).

When an intervention requires large fixed costs (such as investing in major facilities, mounting a media-based health education program, or devising regulations and procedures), total program costs need to be weighed against total effects; simple assessment of marginal cost and effectiveness fails to suffice. When fixed cost is an important element of an intervention, understanding the total burden of disease is necessary for estimating potential total intervention effects.

There is often an optimistic bias toward assessing cost-effectiveness under assumptions of favorable targeting and compliance costs and of favorable intervention specificity. One might expect rising marginal costs and decreasing

marginal effectiveness as interventions are extended through populations; these combine to dilute cost-effectiveness. Thus, favorable case cost-effectiveness estimates can be real, but their margin of applicability may be limited. In principle, it is desirable to acquire some sense of the responsiveness of intervention cost-effectiveness to a range of parameters, particularly the extent of application of the intervention. In practice, sensitivity analysis is sometimes possible but often difficult—and comparisons are then made for “representative” estimates of marginal cost-effectiveness to provide general guidance to decisionmakers. When there are great differences in the marginal cost-effectiveness of different interventions, this “general guidance” can suggest important redirections of policy. Differences in marginal costs per DALY across interventions can lead to inefficiency. For example, intervention B is assumed to have a constant cost per DALY of \$60 for a range of expenditure levels up to \$4,000; intervention A starts with a lower cost per DALY (\$20) but one that is rising to \$100 per DALY at an expenditure of \$4,000. When, therefore, at prevailing levels of expenditure on each intervention, cost per DALY is lower for one of them (as it would be for A at an expenditure of \$1,000 on each of them), reallocation of money will increase output without increasing cost. Hence, the previous allocation would have been inefficient.

Epidemiologic information is required to assess how much of each intervention needs to be acquired in light of rising costs per DALY gained. For example, one of the most cost-effective interventions (for adults) is screening hospital blood supplies for human immunodeficiency virus (HIV) seropositivity; as cost-effective as this may be, relatively few deaths can be averted by it. Chemotherapy for patients with tuberculosis, on the other hand, although somewhat less cost-effective, could be expected to save hundreds of times more lives. Resource allocation, then, for interventions, depends on both economic and epidemiologic information because of the strong effect of epidemiology on the rate of increase in marginal costs. (Resource allocation to research, by contrast, should be driven much more by the epidemiologic significance of diseases and the instincts of researchers about where advances might be realized.)

Policy Implications for National Governments

Conclusions for policy are highly dependent on the local epidemiologic, administrative, and financial context; it is within such contexts (at the national or district level) that policy is shaped. All that can be done in a general overview, such as this, is to point to policies that appear approximately valid for a range of countries. Such indications, therefore, are likely to serve as a useful starting point for country- (or district-) specific analysis of policy.

Policy Instruments of Government

When intervention is desirable, governments have available a variety of measures to promote health and prevent disease that include but extend far beyond the usual activities of ministries of health. Governmental interventions may be usefully grouped into the five broad categories discussed below; the first three are associated with modifying the incentives and knowledge of patients and providers.

PROVIDING INFORMATION. Fundamental to any improvements in health behavior among the population are information, knowledge, and skills, ideally reinforced with social support. In recent years, governments have begun to use the media and modern communication technologies to reach the public with information to promote good health behaviors through programs of “information, education and communication.” Often this is done effectively in partnership with the private sector. Perhaps the most notable examples of this in a number of developing countries are mass mobilization efforts in support of immunization campaigns, as well as communication programs to improve maternal weaning practices and promote the practice of family planning. In the United States, recent publication of selected operative mortality and success rates, by hospital, has allowed more informed consumer choice to stimulate quality assessment and control in hospitals.

REGULATION/LEGISLATION. Health ministries generally have considerable regulatory powers—for example, in licensure of practitioners, and in food and drug control and sanitation—though resources for inspection and enforcement are often limited. A central regulatory power of governments lies in the determination of which health services will (can) be privately provided (through market mechanisms or through nongovernmental organizations) and which will be provided by the state. When coupled with effective public education to reach a social consensus, regulatory authority can be an effective tool for health promotion. This is evidenced by the ability of some governments to limit pollution levels and to restrict the advertising of cigarettes or the promotion of infant formula and baby bottles.

TAXES, SUBSIDIES. Taxes or price subsidies can be an important tool available to governments to promote or discourage various practices related to health. The judicious application of high taxes can discourage consumption of cigarettes and excess consumption of alcohol, whereas subsidized prices—for example, for contraceptives—can be a tool to promote desirable behaviors. Fuel taxes can reduce motor vehicle use, thereby decreasing pollution and vehicle acci-

dents, to take another example. Similarly, reduction of subsidies of some very high fat food products can discourage consumption of fat.

DIRECT INVESTMENTS. In many circumstances the only (or best) recourse for the government may be direct investments perhaps with policies of partial cost recovery. Immunization programs and vector control are two examples on the prevention side. The complexity and relative infrequency of many case management procedures, combined with the absence of informed consumers, suggest that a prominent role for government in the financing of a basic level of hospital services may be desirable.

RESEARCH. Even if research results are protected by patent, it can be difficult for the private sector to recoup the cost of research investment, and, when it is recovered, it is at the expense of fully appropriate use of the research product. The economic case is typically strong, then, for heavy contribution by government to finance research. The purpose, of course, is to lengthen the menu for intervention choice.

An Integrated Approach to Policies and Strategies

Policymakers and health planners must use an integrated strategy in their consideration of the cost and effectiveness of interventions rather than dealing with them disease by disease. In this situation, issues of feasibility and sustainability arise.

Feasibility encompasses political, administrative, and logistical considerations. Some policies, such as raising the age of marriage, may not yet be politically acceptable; others, such as establishing environmental monitoring, may not be administratively feasible because of lack of legal authority or trained personnel. Lack of a well-functioning health infrastructure or an efficient distribution system may be a logistical barrier reducing the cost-effectiveness of some strategies in the short run.

Sustainability is a particularly serious concern, since before this decade, few developing countries had seriously attempted to implement a health care program with their own resources, where total population coverage was the objective. Consequently, the international community and national governments are learning that even highly cost-effective interventions like immunization programs may exceed the available resources of some developing countries in the current economic climate. An advantage of the analytical approach is that it identifies a range of health policies and strategies; some of these may require only minimal government resources (for example, regulations), and some can even generate revenue (for example, taxation on tobacco). This

approach does, however, require health ministries to transcend their traditional bounds and look at the entire national development strategy with regard to its consequences for health.

Health interventions are classified as *population-based* or *clinical*. The population-based (or public health) interventions encompass five strategies: (a) change of personal behavior; (b) control of environmental hazards; (c) immunization; (d) mass chemoprophylaxis; and (e) screening and referral. Clinical interventions are assumed to occur, for simplicity, at three levels: (a) the clinic; (b) the district hospital; and (c) the referral hospital. In many cases, of course, any given intervention will address multiple conditions and, indeed, may well have important effects outside the health sector altogether. Perhaps the clearest examples are control of smoking, breastfeeding, and environmental improvements. Limitation of smoking markedly reduces risk for lung cancer, ischemic heart disease, and chronic obstructive pulmonary disease; outside the health sector it reduces (at least to some extent) property damage from fire and frees productive resources for alternative use. Breastfeeding, likewise, has multiple health effects; it enhances child immunity, reduces exposure to infection, provides balanced nutrition and, by suppressing ovulation, postpones the next pregnancy. The cost of breastfeeding, however, includes, as do many health-promoting interventions, substantial amounts of mothers' time—which is not easily valued in terms, say, of wages foregone. Finally, whereas environmental interventions have beneficial health consequences, their main objectives often lie outside the health sector.

Many population-based health interventions have a range of outcomes; in country-specific applications, assessment of the cost-effectiveness of these interventions should, ideally, quantitatively aggregate intervention effects along these multiple dimensions of outcome. Likewise for clinical intervention there will frequently be joint costs (associated, for one example, with the availability of diagnostic facilities in a district hospital); again, in country-specific application, these matters need to be assessed more quantitatively than they can be in a general overview. Multiple-effect and joint-cost problems do complicate the task of assessing cost-effectiveness in many important instances. Still, these problems are relatively minor or can be dealt with by reasonable approximations and simplifications in the analysis.

PERSONAL BEHAVIOR CHANGE. Some personal behavior changes that are favorable for health outcomes tend to occur naturally as incomes rise; these include, at least for many cultures, improved hygienic behaviors, increased energy intake and quality in the diet, and decreased crowding. Improvements in these behaviors are typically important for the pre-epidemiologic transition diseases and can often be affected by educational interventions even though the main

force driving improvements—income increases—is beyond the domain of health policy.

Other behaviors are likely either to be less dependent on income levels (for example, breastfeeding behavior, sexual practices) or to be adversely influenced by income increases, at least for a period of time. Behaviors influenced by income increases include, for example, dietary excess, sedentary lifestyles, smoking, and alcohol consumption. Most of these are risk behaviors for post-transition conditions. Although the natural course of development is unlikely to improve these behaviors, there is more of a scope for affordable government policy to influence them.

Each of the first four of the policy instruments of government noted above may need to be invoked to promote desired behavioral changes. The most direct approach is through mass media. Most governments are using radio and television broadcasts and print mass media to reach the general population with health information and promotional messages. In recent years there have been important developments in mass communication strategies that are greatly enhancing their effectiveness in creating public awareness of health problems and supporting appropriate behavioral changes. Key elements of effective communication programs include identifying the target audiences and conducting preliminary research to tailor the message to their specific needs. Also, the media chosen must be able to reach the target group. Most important, implementation of a communication program must be a learning process—all materials must be pretested and modified, and the effect of the program must be carefully monitored and evaluated. Regulatory policies and, particularly, taxation policies for tobacco, alcohol, and fatty meats show great promise for inducing behavioral change and, currently, are very much underused. The extremely high cost-effectiveness of smoking control makes it, perhaps, the top priority for governmental action; although less well documented, the probably high cost-effectiveness of alcohol control makes it another priority.

ENVIRONMENTAL HAZARDS CONTROL. Environmental health and safety is largely a matter of engineering and regulation to reduce health risks from known environmental hazards, even when occurrences of the hazard may be increasing. Rising incomes help with improving water supply and sanitation and that is likely to be important in prevention of a broad range of infectious and parasitic diseases. Vector control is at least marginally cost-effective for a number of conditions (malaria, onchocerciasis, dengue) in some environments. Industrialization introduces new hazards into the environment (lead, mercury, and the like) that can produce severe lifetime disability if not effectively controlled. Improvements in household ventilation, indoor fireplaces, and cookstoves can substantially reduce risks for chronic obstructive pulmonary

disease. The number of motor vehicles and the distance driven are increasing, thereby increasing the risk of transport-related injuries. Nevertheless, it has been shown that the combined effect of seat belts, speed limits, safer roads, better vehicles, drunk-driving prevention, and so forth, has been to reduce the health risk. Occupational safety measures are important in many specific instances. In principle, *protective* measures can be delivered through environmental intervention; water fluoridation for prevention of caries is one example.

Environmental hazards control requires the following: epidemiologic surveillance if illnesses or injuries related to environmental risks are to be detected swiftly; regular monitoring of potentially hazardous environmental conditions; and regulatory or taxation authority to ensure that appropriate risk reduction actions are taken. Traditionally, environmental control programs in ministries of health have been limited to water, food, and sanitation inspection to reduce infectious diseases. Government capabilities and authority in this area must be greatly expanded to monitor and control a much broader range of environmental risks. Some of the professional and technical capacities required to monitor and regulate environmental hazards may exist in different ministries in government; however, their functions are often limited by insufficient technically trained personnel, limited resources, and, particularly, lack of statutory authority.

Significant government initiatives in environmental hazards control must begin with broad and detailed statutory regulations empowering one or more agencies to take effective actions. Given the scope and magnitude of the tasks to be carried out—which will encompass areas as diverse as law, engineering, medicine, economics, physics, and chemistry—environmental protection agencies may be set up independently of ministries of health. However the administrative structure is organized, the nature of environmental hazards control requires maximum coordination and collaboration among diverse government agencies whose operations will directly, or indirectly, impinge on environmental health.

Resources are limited in developing countries, but the multisectoral character of environmental control programs means that their cost may be spread across government agencies and, by regulation and taxation, through the private sector. Thus, environmental improvements, although still constrained by overall national resources, are not dependent upon the budget of a single ministry such as the ministry of health.

IMMUNIZATION, MASS CHEMOPROPHYLAXIS, AND SCREENING. Immunization, mass chemoprophylaxis, and screening all share certain common characteristics: (a) they involve the direct administration or application of a specific technical intervention to individuals on a one-on-one basis; (b) they are directed to certain target populations; and (c) the coverage of the target

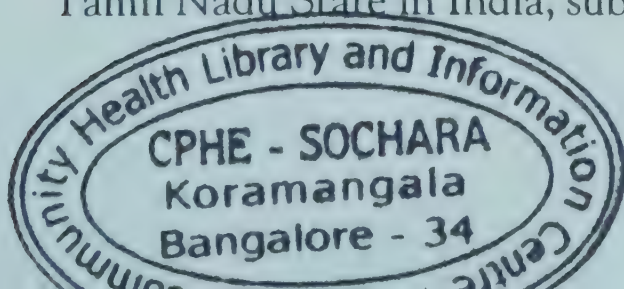
population is important to produce the desired effect. Technically, each of these intervention strategies is highly effective when correctly applied to a compliant subject. However, their actual effectiveness in developing country settings is strongly conditioned by the local administrative, managerial, and logistical capabilities, as well as by traditional cultural constraints.

The one-on-one character of these interventions means that they are intrinsically demanding of personnel and logistical resources. Even if the criteria are satisfied at the planning stage, these interventions require careful monitoring and evaluation for their effect during implementation; any breakdown in the technical requirements of the intervention, any failure to reach the target population, or inadequate compliance with required procedures by the recipients can greatly reduce their cost-effectiveness.

Most immunization interventions are highly cost-effective; and many of them address highly prevalent conditions. Vaccination for measles and tetanus appears particularly cost-effective and worthy of relatively greater attention within immunization programs. Far more could be efficiently spent on immunization than is now being spent; and even though costs of delivery tend to rise as more marginal populations are reached, extending immunization programs to virtually universal coverage is likely to prove both cost-effective and a practical way of significantly improving the health of the poor.

One particularly promising application of mass chemoprophylaxis lies in the administration of anthelmintic medication and micronutrient supplements to school-age children. Here cost-effectiveness appears quite high for conditions that, although of extremely high prevalence, have only recently been seen to be of substantial importance for intellectual and physical development. A program of chemoprophylaxis for school-age children could, like the Expanded Programme on Immunization (EPI) for younger children, be expected to serve as the starting point for an ultimately much expanded capacity to deal with the health needs of this age group; the Rockefeller Foundation and the United Nations Development Programme are jointly initiating such a program.

The strategy of combining child survival interventions into a single package can be very cost-effective if each of the specific interventions is carefully monitored. Each must also be regularly evaluated to see that it meets the standards required for an effective program and that it produces the desired effect on health in the population. If, however, an activity is simply added to an operating program and no procedures have been properly established to ensure a health effect, efficiency will decline. This has frequently been the case when growth monitoring (a screening tool) has been introduced into child survival programs without any provision to attend to children with faltering growth. However, when growth monitoring is used as a tool to manage a population-based nutritional supplementation program, as has been done in Tamil Nadu State in India, substantial program efficiencies can be achieved.



DIS-300
NA3
14027

Cost savings to government for these mass interventions may be achieved through the use of mass mobilization campaigns, in which a substantial contribution in kind may be provided by the private sector. This has been the case with polio immunization “pulse” campaigns conducted at intervals of six months in some Latin American countries. Program efficiencies can also be achieved by focusing efforts in places where the target population will be concentrated. School-based delivery of “targeted mass chemotherapy” has been proposed for intermittent (six-month or annual) mass treatment for helminth infections with the objective of reducing worm burdens, and hence morbidity, without necessarily eliminating infections. The rationale is that in heavily infected populations it is not the acute effects of infection that are the major public health concern. Rather it is the chronic insidious effects of continuous moderate to heavy infection throughout childhood, which reduces the growth and intellectual development of children.

Where provision for treatment and follow-up is available, screening selected populations for infectious diseases is also cost-effective. Examples include miners for tuberculosis and commercial sex workers for sexually transmitted diseases. The latter strategy has recently gained in significance as an important public health intervention for two reasons. First, there is evidence that some STDs play a role in the transmission of AIDS. Second, theoretical work suggests that the epidemic might be much more effectively limited by treating a small core group of infected carriers with multiple sex partners than a much larger group of people with few sex partners. Other diseases for which screening and referral are at least moderately cost-effective are breast and cervical cancer. Active case finding has not been recommended for tuberculosis.

Perhaps the only significant cancers for which treatment is cost-effective (breast, cervical) are ones for which early screening and referral are important; so, as noncommunicable diseases begin to emerge, this strategy will become increasingly relevant. The emerging strategies for treatment of acute respiratory infections in children all rely heavily on community-based programs for early detection and quick referral; with increased experience, improvements in capacity for cost-effective screening and referral programs can be expected to develop.

CLINICAL INTERVENTIONS. As with population-based interventions, national policymakers should have an informed epidemiologic analysis in the local context, along the lines of the framework given here, to guide the allocation of resources across clinical facilities of varying complexity and cost. Operationally, the choices for clinical interventions should actually be for packages of activities, because once certain institutional resources are established (for example, a surgical suite with blood bank), many procedures can be performed at marginal cost. The factor to consider, however, is not just the marginal cost of

the procedure but its cost-effectiveness with regard to disability-adjusted life-years gained. Institutional capacities will be limited; time and resources spent on relatively ineffective procedures, such as surgery for lung cancer, will be taken away from resources that could be spent on highly cost-effective interventions, such as cesarean section for obstructed labor. Economies of scale will (or will not) result from a packaging of services or from delivering required volumes of procedures. From the standpoint of public policy, the extent to which this is so determines the extent to which competitively provided services can be efficient in any given demand environment. There is much anecdotal evidence to suggest that actual economies of scale sharply limit the scope for competition to be efficient, suggesting the importance of government in financing a basic level of care or regulating hospital services.

Facilities to provide clinical intervention vary continuously in size, in the degree of complexity (and range) of the conditions that they address, in the sophistication of their facilities and equipment, and in the training and skill of their staff. There is a paucity of data relating to the effect and cost of clinical interventions. This severely constrains analysis of the desirability of public health intervention and also of clinical interventions that might be mounted at various levels of the referral system. In the absence of such analyses, it is perhaps natural for developing countries to import, to the extent that resources permit, the methods of case management used or being developed in high-income countries. The key phrase here is, of course, "to the extent that resources permit." Available resources permit importation of high-cost interventions for only a tiny proportion of a developing country's population. There is a rich range of technologies and procedures now in existence or coming into being, to extend access to services for the rapidly emerging AIDS epidemic and for the impending epidemic of noncommunicable disease. From this source, radically lower cost methods of case management must be developed.

Several observations on the cost-effectiveness of clinical interventions should be noted:

- Curative care for tuberculosis and sexually transmitted diseases appears extremely cost-effective; further, such care is not now being provided to the extent it should be, given the high burden of morbidity and mortality resulting from these conditions. Surgical treatment of cataract is also highly cost-effective.
- The range of clinical interventions of moderate cost-effectiveness is extremely diverse. (Medical management of angina or diabetes are examples, as is surgical management of cervical cancer.) This diversity suggests that country-specific analyses of such conditions are required and that facilities capable of competently handling diverse conditions will need to be developed.

- Some clinical interventions seem too expensive to be cost-effective even if they are clinically effective (as is the case with coronary artery bypass grafting to deal with angina). This suggests that their use should be actively discouraged until other, more cost-effective interventions can be delivered to their appropriate potential.
- Control of pain from terminal cancer could benefit perhaps 1.5 million individuals annually at acceptable costs; current legislation and standard practices greatly limit what is done in relation to what potentially could be done.
- Rehabilitation (in particular from leprosy, poliomyelitis, and injury) shows promise of being extremely cost-effective. However, very little attention has been accorded rehabilitation, and little is known about how best to provide services on a population basis or how effective and costly they might be.

Many interventions are clearly *not* cost-effective, and public policy should make every effort to discourage their use. But the available evidence does suggest that a broad range of interventions, addressing a similarly broad range of conditions, *will* prove cost-effective. Many of these interventions are not now being used to the extent that they should be. Likewise, much of what is currently undertaken by the clinical system is misdirected (toward interventions of low cost-effectiveness) or simply inefficiently used. Redirection of substantial resources from interventions of low cost-effectiveness toward those with very high cost-effectiveness is clearly possible; a central task of health policy must be to design implementation strategies and government policy instruments that can promote these potential efficiency gains.

CONTINUING EDUCATION FOR HEALTH CARE PROVIDERS. A critical element in developing cost-effective health care systems is the reorienting and retraining of health care providers. The vast majority of doctors, nurses, and other health care providers do not have the necessary training and technical skills to provide even basic contraceptive technologies. This has been revealed by worldwide experience in initiating national programs to provide family planning services and child survival technologies. Diarrhea management has been rationalized by the introduction of oral rehydration therapy. Yet even now, in countries in which oral rehydration therapy has been introduced and available for five to ten years, many physicians typically administer unnecessary and, at times, dangerous drugs to patients with diarrhea. Similarly, in cases of acute respiratory illnesses medical practitioners may prescribe as many as three to six drugs, including more than one antibiotic, often in ineffective doses. Furthermore, systematic patient follow-up is rarely carried out in primary health care facilities to see if the treatment has been effective.

Many of the limitations described above are the result of resource constraints; however, it should be apparent that there will be no cost-saving by poorly trained personnel dispensing ineffective treatments. With limited resources, gains in cost-effectiveness can be achieved only by limiting the range of conditions to be cared for, and by doing the job well. The selective disease-specific strategy of vertical programs is commonly criticized because of the presumed lack of efficiency in the use of medical manpower. Nevertheless, it has had the advantage of focusing attention on each critical step necessary to make an intervention effective. At the same time, such a strategy builds a base of practitioner competence that can later be extended to providing a broader range of services.

An important step in the process of improving the qualifications of health providers is strengthening professional associations. Currently, professional associations in many developing countries are heavily dependent on commercial enterprises (primarily the pharmaceutical industry) for national meetings, publications, and continuing education. With this limited exposure to technical developments, health providers are in no position to judge the merits (much less the cost-effectiveness) of new products for patient care. Continuing education with recertification of competence, which is a requirement in highly developed countries like the United States, where physicians have virtually unlimited access to the medical literature, is essential in developing countries, where resources are severely constrained. National professional associations could play a vitally important role in this area, but government financial support is likely to be required to facilitate provision of unbiased information.

TECHNOLOGY ASSESSMENT, DEVELOPMENT, AND CONTROL. Even a wealthy nation like the United States practices cost containment. For example, private hospitals are not permitted to introduce expensive high-technology procedures (e.g., open-heart surgery) without permission of a government-mandated review board; this assesses the demand for heart surgery and the availability of the procedure in other hospitals in the area. The hospitals themselves are also shortening the duration of inpatient stay and moving many procedures to the outpatient facilities to cut costs. Consumer groups, meanwhile, are demanding cost-saving innovations like the availability of less expensive generic drugs instead of the costly proprietary products.

In the financially constrained environment of developing countries, cost containment is even more essential. To move in this direction requires institutional capabilities as described in the section "Policy Implementation and Health System Responses." But beyond a control function is the critical need for research to adapt highly effective technologies to developing countries. This was done with oral rehydration therapy for diarrheal diseases, and steps are

being taken to simplify the diagnostic requirements for effective treatment of acute respiratory infections.

Medical technology has been adapted to developing country settings through both prevention and medical treatments and through surgery. Female surgical sterilization traditionally had been an inpatient procedure done under general anesthesia. However, over the past twenty years, experience has accumulated with a minilaparotomy that can be done under local anesthesia on an outpatient basis. Cataract extraction is another procedure adapted to conditions in developing countries. High-volume surgical facilities have been in place in India and Pakistan for the past twenty years. In these settings, cataract surgery can be performed inexpensively and safely on an assembly-line basis. More recently, a pilot program in Kenya has demonstrated that nonphysician ophthalmic clinical officers can be trained to perform cataract surgery with acceptable results.

An important case study of the adaptation of technology on a national scale is the "simplified surgery system" developed in Colombia. Controlled trials of selected surgical procedures were conducted, comparing their safety and effectiveness when performed as ambulatory procedures with that when performed as inpatient procedures. The results indicated that 75 percent of surgical interventions did not require hospitalization. The government has now instituted a nationwide program of ambulatory surgery.

Analytic Capacity Building

Measurement of the nature and magnitude of the health problem in a population and its trends and determinants is essential to design intervention strategies that maximize the effectiveness of the health technologies. Correspondingly, in the absence of quantitative indicators of program performance, it is impossible to assess the efficiency of an intervention strategy, much less undertake analyses of the cost-effectiveness ratios of alternative policy options. Managers of the smallpox eradication program stress the central role that outcome measurements played in the success of that program.

In health intervention programs, measurement problems are complex, but work has begun in developing the survey tools and analytical methods. The microcomputer is the most important technical advance supporting the development of strengthened information systems. Microcomputers have now been adapted for a wide range of health care applications by the World Health Organization and the centers for disease control in developing countries. These applications include management of primary health care programs and drug supply systems, monitoring of immunization coverage, and standardizing of nutrition surveys. Specialized software packages are also available for demographic data analyses, field survey research applications, health and population

program planning, and so forth. Wide application of epidemiologic and economic analyses will require much more trained manpower in developing countries.

Many governments will need to encourage the creation of new institutions or reconfigure old ones in order to address the issues identified here. Critically needed capacities include the following:

- *Demographic Analysis:* Such data will provide the basis for designing intervention strategies as well as for assessing the effect of the disease burden on the population. There must be accurate measures of the numbers and distribution of the population, its social and economic characteristics, and the trends and determinants of population change.
- *Epidemiologic Surveillance:* This capacity is essential to assess the magnitude of health problems, define their determinants, and monitor the effect of health program interventions. In most developing countries, epidemiologic capacities will need to be greatly strengthened as health program strategies move more toward regulation, taxation, subsidies, and information programs in order to reduce acute and chronic disease risks by changing behaviors and improving environmental safety.
- *Economic Analysis:* Economic analysis will be essential to measure the cost-effectiveness of alternative intervention strategies as well as to assess the overall claim of the health sector on scarce development resources. Building capacities in this area involves strengthening health service information systems to measure more effectively the resource inputs, the operations of the service delivery system, and its program outputs. Continuing comprehensive analyses of these data will be required to determine the cost-effectiveness of various operational programs. This activity must encompass the private as well as the public health care sector.
- *Health Technology Assessment:* This is one aspect of cost-effectiveness analysis. Institutional capabilities in this area must include the assessment not only of the effectiveness of new drugs, vaccines, or equipment but also of their costs and benefits when introduced into the health system. For example, there may need to be some control of the introduction of expensive high-technology health care interventions, such as computerized axial tomography (CAT) or open-heart surgery, in order to control health service delivery costs. More important, drugs account for 40 to 60 percent of the health budget in many developing countries (not including private expenditure). There is, therefore, an urgent need to build up the institutional resources to assess these products, not only for their safety and effectiveness, but for their use and cost.

Policy Implementation and Health System Responses

The discussion above leads to five central conclusions for policy:

- A comprehensive health policy should move on multiple fronts simultaneously, considering the full range of facility-based and population-based options for any problem being addressed.
- Health strategies should be goal oriented, with specific quantitative intermediate objectives against which program achievements can be measured.
- Planning the appropriate intervention mix should specify as far as possible the quantitative relationships between program inputs (and their costs), outputs, and expected outcomes.
- Information systems must be established that provide timely data on health outcomes, intermediate objectives, and program inputs and costs.
- Instruments of government policy and their input-output-outcome relationships must be regularly analyzed to ensure that the instrument mix really does induce the desired level of operation of the range of interventions.

Selecting health care priorities in a given setting is only the first step toward improving the allocation of resources in the health sector. The analysis of the burden of disease would ideally lead to a list of health problems ranked by order of importance. But clearly, the fact that a health problem is high priority does not lead automatically to the decision that the government should invest in prevention or case management. The role of cost-effectiveness analysis is to inform decisionmakers what interventions are likely to yield more years of healthy life and therefore are preferable. The results from the cost-effectiveness analysis can be used to make decisions at two different levels: first, to set priorities among the alternative interventions available to control a specific disease (for example, measles) or to reduce the exposure of the population to a specific risk factor (for example, tobacco); second, to set priorities within the health sector, selecting the most cost-effective interventions for those health problems that produce the greatest burden of disease.

The identification of these high-priority interventions still is insufficient to justify public investment. For example, it is clear that in many countries, some of the cost-effective interventions are already being delivered by the private sector (including traditional practitioners) or by voluntary organizations and, therefore, intervention by the government is not justified. In family planning, for example, there is strong involvement of the private sector in many countries.

High-priority interventions, for which government involvement is justified, deserve a level of investment to achieve the greatest possible coverage and the

highest quality standards. But to achieve these goals and the ultimate outcome on health status, the health system needs to have the infrastructure and organization to deliver the services. Table 2 shows a framework that integrates three criteria—burden of disease, cost-effectiveness, and health system strength—to set priorities and define more specifically the response from the health system. Strategies are suggested to strengthen the health system, if the system is weak. This would include development of trained staff and necessary infrastructure. Other possible combinations of these three criteria are also shown, and possible responses from the health system are suggested. Importantly, this framework indicates that an intervention with a very unfavorable cost-effectiveness ratio that is aimed at controlling a disease with low prevalence and low lethality clearly is a good candidate for rationing or elimination.

Another combination of criteria of interest to developing countries passing through the later phases of the epidemiologic transition is that of available interventions for high-priority diseases that have unfavorable cost-effectiveness ratios. AIDS offers the most obvious example of this situation. Here control of transmission in the core population has the potential for being cost-effective but actual application of the interventions is difficult. The proposed response given in table 2 is research, both basic and operational. Operational research would be aimed at improving the cost-effectiveness of current approaches to patient care and to promoting and supporting behavioral change. Basic research would be directed to developing new interventions, that is, vaccines or better

Table 2. Responses of Strong and Weak Health Care Systems to Burden of Disease

Burden of disease	Intervention cost-effectiveness	Strong health systems	Weak health systems
High	High	Aim for full population coverage Improve quality of services provided	Reorient/train existing staff Develop technical/ management systems Establish infrastructure
	Low	Research to improve interventions Do not expand services Institute cost recovery	Research to improve interventions Restrict or eliminate services
Low	High	Target high-risk groups	Provide services on demand
	Low	Restrict services or provide cost recovery	Eliminate services

Source: Authors' design.

drugs which will cost less and become more effective. The discussion of clinical interventions (above) demonstrates the uses of both types of research. The discussion noted that in the control of emerging noncommunicable diseases, tertiary hospital care is not now cost-effective. Effective control will probably depend on the development of lower-cost interventions that can be provided in district hospitals and health centers or through population-based programs.

Despite the importance of using explicit criteria to set health priorities for public investment in developing countries, there is not much experience with country-level applications. An important exercise was undertaken in the late 1970s in Ghana, however. This used the number of healthy days of life lost to assess the effect of diseases on health, and cost-effectiveness analysis to assess the appropriateness of alternative interventions. Five disease conditions were considered, namely, malaria, measles, childhood pneumonia, sickle-cell disease, and severe malnutrition. The results were used in the design of the Ghanaian primary health care program, and the methodology proposed has served as a yardstick for subsequent developments in the assessment of the burden of disease.

International Aid

Many of the successful experiences with aid in the health sector have had as their objective the *provision of services* where no services, or only inadequate services, were available. The smallpox eradication effort had this objective, as does its successor, the Expanded Programme on Immunization (EPI). Mission hospitals, too, are oriented toward provision of service, as are many other forms of assistance.

The capacity of a country to deliver services will, it is increasingly recognized, depend a great deal on the *policy environment* in which systems for delivering services must function. The policy environment defines a range of key structural conditions: the mandated division of labor among public, private, and nonprofit nongovernmental organization sectors; cost-recovery policy (and financing policy more generally); referral policy; pharmaceutical policy; policy toward prevention; policy toward taxation or subsidization of health-influencing processes or commodities; and policy toward distribution of access to services. Obviously some policy environments will be conducive to inefficiency or inequity; others less so.

The potential importance of aid in assisting with improving policy has been the subject of much attention and debate in the past five to ten years. Policy-oriented aid inevitably has the flavor of exchange of policy reform for financial assistance. The extent to which such exchange is productive depends greatly on three things: on the strength of those factions in the country who are intellectually (or otherwise) committed to reform, on the substance and

style of the discussions leading to agreement, and on the inherent viability of the measures adopted. Most policy-based aid to date has been concerned with improving macroeconomic policy; more than \$1.5 billion of World Bank (and International Development Association) lending in fiscal year 1989, for example, was for "structural adjustment loans" (SALS), involving fast disbursing resource transfer and macroeconomic conditionality. The World Bank is now also using "sector adjustment lending" instruments; incremental, highly flexible resources are made available to a sector in tranches released on certification of specified progress in policy improvement. Efforts to help improve the policy environment through sector adjustment lending are playing an increasingly important role in health sector operations at the World Bank, sometimes closely tied to provision of service in so-called hybrid projects.

Some aid to the health sector is channeled *to research and to development of research capacity* in recipient countries. Among the programs are the following: the Programme for Research and Training on Tropical Diseases, the Human Reproduction Program, the International Clinical Epidemiology Program, and blindness-related programs on trachoma and onchocerciasis. Other important programs are well established; many of them, like the Programme for Research and Training on Tropical Diseases and the Human Reproduction Program, are managed by the World Health Organization and funded by multiple donors. The Commission on Health Research for Development provided an extraordinarily thorough critical review of current efforts and capacities and of desirable directions for future effort. A follow-on secretariat to the commission has been established in Geneva to facilitate research efforts of individual countries.

Much research important for resource allocation is relatively nontransportable—local epidemiologic and operational analyses being important examples. Many research results, however, are transportable; lessons from Senegal and the Gambia about the effectiveness in the field of oral and injectable polio vaccine, for example, are probably almost as relevant in South Asia as they are in West Africa. Transportable research leads (in economists' jargon) to important informational externalities. The existence of these informational externalities, combined with substantial research capacity in donor countries, makes research a particularly viable domain for aid. In addition, the requirement for a substantial critical mass of highly qualified (and, therefore, highly paid) scientists for much research points toward internationalization of the conduct of that research (as well as of its finances). This suggests the desirability of relatively few (but productive) venues with broad participation on the staff.

The current volume of resources going into research is quite limited. The Commission on Health Research estimated, for example, that perhaps only a few pennies per death per year are going into research on such significant third-world killers as acute respiratory infections and tuberculosis. Although relatively more is invested in tropical and parasitic disease research, the overall

DIS-300
14027

amount is quite limited. The commission estimates that only about 5 percent of the \$30 billion spent on health research in 1986 was oriented toward developing countries.

Vaccine development efforts have the potential both for providing cost-effective prevention for a much broader range of conditions than is now possible and for reducing the cost and logistical complexity of currently available vaccines. In relation to potential, research of this sort currently receives very limited support—although the recent move toward creation of a children's vaccine initiative suggests that solutions to this problem may soon emerge.

In summary the objectives of external assistance involve improving service delivery, improving the policy environment, and supporting the generation of research findings that underpin development of new interventions or more informed choice from among existing ones. Intervention concerning each objective can be divided into two modalities: *program implementation* and *capacity strengthening*. Interventions oriented toward attainment of results in the short term (and, often, this will be important) naturally emphasize the program implementation modality. In the long term, however, strengthening capacity (usually capacity at the national or subnational level) is essential, and, increasingly, assistance programs include substantial resources for capacity strengthening through institutional development. Often this involves direct assistance to an institution—for example, a ministry headquarters or a hospital—designed to improve its overall functioning. Relevant efforts may include staff training, reorganizational advice, or support for development of information systems. Often of particular importance for capacity strengthening is investment in education and training facilities for health professionals, including nursing, medical, and public health faculties. To be effective, such investment may require a long time horizon; but the payoff can be very substantial indeed.

Conclusions

Estimates of the levels and structure of cause of mortality strongly suggest that the number of deaths will increase rapidly in developing countries. Such estimates also suggest there will be a substantial (although incomplete) shift in the distribution of causes to the relatively expensive noncommunicable diseases of adults and the elderly. This shift, and the epidemiologic diversity likely to result from a lingering heavy burden of communicable disease, will challenge health systems. They will be called upon to mount a broader range of preventive interventions and to develop very low cost protocols for managing cases in increasing numbers. Several general conclusions follow:

- The increasing burden of noncommunicable disease is initially likely to affect the relatively more affluent and politically vocal older age groups.

Governments will therefore need to take great care to ensure *completion of the unfinished agenda* for improving the health of children and the poor in the face of resource demands placed (predominantly) by the relatively better off. Almost certainly this equity objective will be consistent with extending the investments in immunization and other interventions against infectious diseases, which offer the greatest gains in healthy life per dollar invested. A key input to completing the unfinished agenda will be investment in research on vaccines—both to increase the range of conditions to be addressed and, more important, to simplify delivery logistics.

- Many of the risk factors for noncommunicable disease (smoking, sedentariness, increased motor vehicle use) tend, for at least a time, to become more prevalent with increasing affluence; in this they differ from risk factors for most communicable diseases (with the exception of AIDS). The disadvantage of this is obvious; the advantage is that taxation-based preventive policies can actually generate revenue for government while promoting health. More generally, increasing epidemiologic diversity will require a broader range of preventive measures; increasing use of the full range of government policy instruments (like taxes) can play an important role in implementing them. Of particular importance here is prompt national and international action to control tobacco use. Acquisition of tobacco addiction by today's youth generates the dynamic for lung cancer, COPD, and cardiovascular disease epidemics in fifteen to thirty years. Taxes, prohibition on job promotion, and other effective interventions are available, and their prompt implementation is high priority.
- A great effort will be needed to preserve resources for the poor and to ensure broad access to reasonable treatment. Such effort must include implementing (or developing) *low-cost* ways of reaching the goals of secondary prevention, cure, and rehabilitation. This effort should also provide humane palliation for those whose lives could only be marginally extended (if at all) by affordable intervention. Some methods that are reasonably cost-effective have been identified, but significant efforts are required to develop and evaluate a more comprehensive range of low-cost therapeutic interventions.
- Today's allocation of *research resources* to the health sector in developing countries virtually ignores the problems that will dominate the policy agenda in years to come. This situation may have several roots: a sense that current research priorities should mirror operational ones; a sense that the National Institutes of Health in the United States and their sister institutions around the industrial world are doing what needs to be done about chronic disease; and, perhaps, a lack of appreciation for epidemiologic dynamics. Yet, case management of chronic disease will have to

proceed in environments drastically more cost-constrained than the ones for which institutions such as the National Institutes of Health are working; relevant research and development efforts must be modified and evaluated for cost-effectiveness in very different environments. Likewise, very little indeed is known, for example, of the descriptive epidemiology of cardiovascular disease in the developing world, and no available risk models are based on developing country data, which might include risk factors not observed in industrial countries. The list of examples could go on; the analytic effort to address the emerging health problems of developing countries in the 1990s and beyond has barely begun.

- Just as manufacturers with older equipment expect higher maintenance costs, older populations will generate, for a variety of reasons, higher health maintenance costs for their country. National economic planners should expect to see, as populations age, expenditure on health steadily rising as a percentage of the gross national product in the coming decades.

Contents of the Book

Preface

Acknowledgments

Contributors

VOLUME I

PART ONE Introduction

1. Disease Control Priorities in Developing Countries: An Overview
Dean T. Jamison
2. Causes of Death in the Industrialized and Developing Countries:
Estimates for 1985–90
Alan D. Lopez
3. The Epidemiologic Transition and Health Priorities
*José Luis Bobadilla, Julio Frenk, Rafael Lozano, Tomas Frejka,
and Claudio Stern*

PART TWO The Unfinished Agenda, I · Infectious Disease

4. Acute Respiratory Infection
Sally K. Stansfield and Donald S. Shepard
5. Diarrheal Disease
José Martines, Margaret Phillips, and Richard G. Feachem
6. Poliomyelitis
Dean T. Jamison, Alberto Torres, Lincoln Chen, and Joseph Melnick
7. Helminth Infection
*Kenneth Warren, Donald Bundy, Roy Anderson, A. R. Davis,
D.A. Henderson, Dean T. Jamison, Nicholas Prescott, and Alfred Senft*
8. Measles
Stanley O. Foster, Deborah McFarland, and Meredith John
9. Tetanus
Robert Steinglass, Logan Brenzel, and Alison Percy

10. Rheumatic Heart Disease
*Catherine Michaud, Jorge Trejo-Gutierrez, Carlos Cruz,
and Thomas A. Pearson*
11. Tuberculosis
Christopher Murray, Karel Styblo, and Annik Rouillon
12. Leprosy
Myo Thet Htoon, Jeanne Bertolli, and Lies D. Kosasih
13. Malaria
José Nájera, Bernhard Liese, and Jeffrey Hammer
14. Dengue (with notes on Yellow Fever and Japanese Encephalitis)
Donald Shepard and Scott Halstead

PART THREE The Unfinished Agenda, II · Reproductive Health and Malnutrition

15. Hepatitis B
Mark Kane, John Clements, and Dale Hu
16. Excess Fertility
Susan Cochrane and Frederick Sai
17. Maternal and Perinatal Health
*Julia Walsh, Chris N. Feifer, Anthony R. Measham,
and Paul J. Gertler*
18. Protein-Energy Malnutrition
*Per Pinstrup-Andersen, Susan Burger, Jean-Pierre Habicht,
and Karen Peterson*
19. Micronutrient Deficiency Disorders
Henry M. Levin, Ernesto Pollitt, Rae Galloway, and Judith McGuire

VOLUME II

PART FOUR Emerging Problems

20. HIV Infection and Sexually Transmitted Diseases
Mead Over and Peter Piot
21. Cancers
Howard Barnum and E. Robert Greenberg

22. Diabetes
J. Patrick Vaughan, Lucy Gilson, and Ann Mills
23. Cardiovascular Disease
Thomas A. Pearson, Dean T. Jamison, and Jorge Trejo-Gutierrez
24. Chronic Obstructive Pulmonary Disease
Richard Bumgarner and Frank E. Speizer
25. Injury
Sally K. Stansfield, Gordon S. Smith, and William McGreevey
26. Cataract
Jonathan C. Javitt
27. Oral Health
Douglas Bratthall and David E. Barmes
28. Schizophrenia and Manic-Depressive Illness
Peter Cowley and Richard Jed Wyatt

PART FIVE Conclusion

29. The Health Transition: Implications for Health Policy in Developing Countries
W. Henry Mosley, José Luis Bobadilla, and Dean T. Jamison

Appendixes

- A. Control of Tobacco Production and Use
Kenneth Stanley
- B. Reducing Mortality in Children Under Five: A Continuing Priority
Carl Taylor and Vulmiri Ramalingaswami
- C. Priority Setting for Health Service Efficiency: The Role of Measurement of Burden of Illness
Gavin Mooney and Andrew Creese
- D. Rationales for Choice in Public Health: The Role of Epidemiology
André Prost and Michel Jancloes

Of Related Interest

The Health of Adults in the Developing World

Edited by Richard G.A. Feachem,
Tord Kjellstrom, Christopher J.L. Murray,
Mead Over, and Margaret A. Phillips

Many adults in developing countries suffer from chronic medical problems that seriously burden health services. Because adult illness often consumes over half of the developing world's limited medical resources, a better understanding of adult health is urgently needed.

This book documents the burden of adult ill-health in the developing world. The overall death rate for adults is analyzed, including such major causes of death as tuberculosis, diabetes, heart disease, cancer, and injury.

The study examines problems that lead to adult ill-health — such as infectious diseases and poor nutrition — and suggests ways to deter them. Also discussed are cost-effective preventive options in case management and primary and secondary care, along with ways to reduce the severity of many diseases.

Published for the World Bank by Oxford University Press

360 pages / ISBN 0-19-520879-X Order Stock #60879 / US\$34.95

Also Available

**The Health of Adults in the Developing World
A Summary**

48 pages / ISBN 0-8213-2591-4 / Order Stock #12591 / US\$6.95

To order, please use the coupon that follows

World Bank Publications Order Coupon

CUSTOMERS IN THE UNITED STATES:

Complete this coupon and return to

**The World Bank
Box 7247-8619
Philadelphia, PA 19170-8619
U.S.A.**

To receive your books faster just call
(202) 473-1155, or transmit your order
by fax (202) 676-0581.

CUSTOMERS OUTSIDE THE UNITED STATES:

Contact your local World Bank Publications distributor for information on prices in local currency and payment terms. (A complete list of distributors follows this coupon.) If no distributor is listed for your country, use this order form and return it to the U.S. address. Orders that are sent to the U.S. address from countries with distributors will be returned to the customer.

Quantity	Title	Stock Number	Price	Total
	Disease Control [Full Edition]	60990	\$79.95	
	Disease Control . . . : A Summary	12480	\$6.95	
	Health of Adults [Full Edition]	60879	\$34.95	
	Health of Adults . . . : A Summary	12591	\$6.95	

Note: French and Spanish editions of both summary editions will be available in early 1994. Please contact World Bank Customer Service or your local distributor for more ordering information.

Subtotal US\$ _____
Postage and Handling* US\$ _____
Total US\$ _____

If purchase order is used, actual postage will be charged. If payment is by check or credit card, postage & handling charges are \$3.50 per order. For air mail delivery outside the U.S., include an additional US\$6.00 per item.

CHECK METHOD OF PAYMENT

☐ Enclosed is my check payable to The World Bank.

☐ Charge my ☐ VISA ☐ MasterCard ☐ American Express

Credit card account number

Expiration Date

Signature

☐ Bill me. (Institutional customers only. Purchase order must be included.)

PLEASE PRINT CLEARLY

Name _____

Firm _____

Address _____

City _____ State _____ Postal Code _____

Country _____ Telephone _____



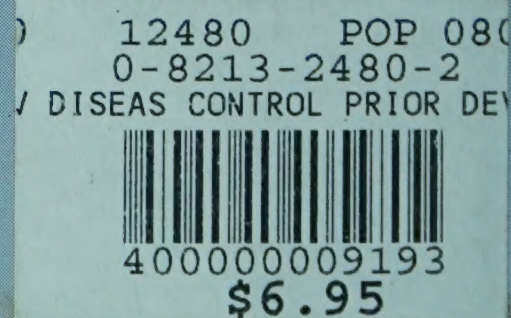
The World Bank

Noncommunicable disease is rapidly increasing in developing countries while, at the same time, the battle against communicable disease is still far from won. This means that policymakers face hard choices in the allocation of scarce resources for health.

Disease Control Priorities in Developing Countries reviews the public health consequences of about thirty conditions prevalent in the developing world and measures the cost-effectiveness of existing methods of control. The analysis covers major infections such as tuberculosis and malaria, nutritional deficiencies and conditions affecting reproductive health, and emerging health problems such as AIDS, cancer, and cardiovascular disease. Tobacco is discussed as possibly the single greatest threat to health in the developing world.

The authors judge the cost-effectiveness of alternative approaches to prevention and case management and, in a concluding chapter, provide a set of policy recommendations.

DEAN T. JAMISON is a professor of public health and of education at the University of California, Los Angeles. He serves as part-time adviser on population, health, and nutrition to the Latin America and the Caribbean Regional Office at the World Bank. W. HENRY MOSLEY is chairman of the Department of Population dynamics at the Johns Hopkins School of Hygiene and Public Health. ANTHONY R. MEASHAM is adviser for population, health, and nutrition in the New Delhi resident mission of the World Bank. JOSE LUIS BOBADILLA is a senior health policy specialist in the Population, Health, and Nutrition Department at the World Bank.



ISBN 0-8213-2480-2